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IS 3885-2 (1992): Steel for the Manufacture of Laminated Springs (Railway Rolling Stock), Part 2: Rib and Groove Sections [MTD 4: Wrought Steel Products]



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भारतीय मानक

पटलित कमानी (रेल डिब्बे) के निर्माण के लिये इस्पात

भाग 2 रिब तथा खाँचा सेक्शन

(दूसरा पुनरीक्षण)

Indian Standard

STEEL FOR THE MANUFACTURE OF
LAMINATED SPRINGS (RAILWAY
ROLLING STOCK)

PART 2 RIB AND GROOVE SECTIONS

(Second Revision)

UDC 669.14-41 : 621-272.3 : 625.2

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1969 and then revised in 1977. In the light of further experience gained with the usage of this standard, it has been decided to revise it with the following major modifications:

- a) Secondary refining or secondary vacuum-melting shall be adopted while manufacturing steel.
- b) Minimum reduction ratio has been modified to 16 : 1 in place of 10 : 1.
- c) Depth of the decarbonisation (partial plus complete) has been incorporated.

Only rib and groove sections are covered in this part while flat sections are covered in Part 1 of the standard.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

STEEL FOR THE MANUFACTURE OF LAMINATED SPRINGS (RAILWAY ROLLING STOCK)

PART 2 RIB AND GROOVE SECTIONS*(Second Revision)***1 SCOPE**

1.1 This standard covers the requirements for hot rolled steel rib and groove sections intended to be used for the manufacture of laminated springs for railway rolling stock.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
228	Methods of chemical analysis of steels (<i>second revision</i>)
1500 : 1983	Method for Brinell hardness test for metallic materials (<i>second revision</i>)
6396 : 1983	Method for measuring decarburized depth of steel
4163 : 1982	Method for determination of inclusion content in steel by microscopic method (<i>first revision</i>)
8910 : 1978	General technical delivery requirements for steel and steel products

3 GRADES

3.1 Steel shall be of seven grades as specified in Table 1.

4 SUPPLY OF MATERIAL

4.1 General requirements relating to the supply of material shall conform to IS 8910 : 1978.

5 MANUFACTURE

5.1 Steel shall be manufactured by any process of steel making except the bessemer process. It shall be followed by secondary refining or secondary vacuum melting.

5.2 The size of the ingot billet or continuous cast billet for any given size of finished steel products shall be such that a minimum reduction ratio of 16 : 1 from the minimum cross-sectional area of the ingot, billet or continuous cast billet to the maximum cross-sectional area

of the product is ensured. However, reduction ratio other than that specified may be agreed subject to mutual agreement between the purchaser and the manufacturer.

6 CHEMICAL COMPOSITION

6.1 The ladle analysis of the steel, when carried out by the method specified in the relevant parts of IS 228 or any other established instrumental/chemical method, shall be as given in Table 1. In case of dispute the procedure given in the relevant parts of IS 228 shall be the referee method. However, when the method is not given in IS 228 and its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

6.2 Incidental Elements

Element not quoted in Table 1 shall not be intentionally added to the steel without the agreement of the purchaser, other than for the purpose of finishing the heat. All reasonable precautions shall be taken to prevent the addition, from scrap or other materials used in manufacture of such elements which effect the hardenability, mechanical properties and applicability.

6.3 Product Analysis

The permissible variation in case of product analysis from the limits specified in Table 1 shall be as follows:

<i>Constituent</i>	<i>Permissible Variation Over Specified Limit Percent</i>
Carbon	±0.03
Manganese	±0.04
Silicon :	
Upto and including 0.40	±0.03
Above 0.40	±0.05
Sulphur	+0.005
Phosphorous	+0.005

NOTE — Variation shall not be applicable both over and under the specified limits in several determinations in a heat.

Table 1 Chemical Composition
(Clauses 3.1 and 6.1)

Grade	Designation*	Type	Constituent, Percent						
			Carbon	Silicon	Manganese	Sulphur	Phosphorus	Chromium	Vanadium
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	55C6	Water-hardening	0.50 to 0.60	0.15 to 0.30	0.50 to 0.60	0.050	0.050	—	—
2	75C6	Oil-hardening	0.70 to 0.80	0.15 to 0.35	0.50 to 0.80	0.050	0.050	—	—
3	40Si7	Water-hardening	0.35 to 0.45	1.50 to 2.00	0.80 to 1.00	0.045	0.045	—	—
4	55Si7	Oil-hardening	0.50 to 0.60	1.50 to 2.00	0.80 to 1.00	0.045	0.045	—	—
5	50Cr4V2	Oil-hardening	0.45 to 0.55	0.15 to 0.35	0.50 to 0.80	0.045	0.045	0.90 to 1.20	0.15 to 0.30
6	60Cr4V2	Oil-hardening	0.55 to 0.65	0.15 to 0.35	0.80 to 1.00	0.045	0.045	0.90 to 1.20	0.15 Min
7	51CrMoV4	Oil-hardening	0.48 to 0.56	0.15 to 0.40	0.70 to 1.10	0.035	0.035	0.90 to 1.20	0.07 to 0.12 0.15 to 0.25

*See IS 1762 (Part 1) : 1974 'Code for designation of steel : Part 1 Based on letter symbols (first revision)'.

7 HARDNESS

7.1 The hardness of the material when tested in accordance with IS 1500 : 1983 shall be as given in Table 2.

Table 2 Hardness, HB Max

Grade	Hardness HB	
	Untreated Condition (For Guidance only)	Annealed Condition Max
5506	—	240
7506	—	240
40Si7	≈ 270	245
55Si7	≈ 270	245
50Cr4V2	≈ 310	245
60Cr4V2	≈ 310	255
51CrMoV4	≈ 310	255

7.1.1 In case of as-rolled material, the limits for hardness other than those given in Table 2, may be mutually agreed upon at the time of enquiry and order.

8 DECARBURIZATION

8.1 Complete Decarburised Depth

It is the depth measured at right angles to the surface of the zone which contains at least 90 percent ferrite.

8.2 Partial Decarburised Depth

It is the depth measured at right angles to the surface of the zone which contains less carbon

than the general carbon content of the core. The limit of this zone is the point where a microstructural change between the surface and the core is apparent.

8.3 Total Decarburized Depth

It is the sum of the complete and partial decarburised depths.

8.4 The average total depth of the decarburization (partial plus complete) shall not exceed 1.5 percent of the thickness of flats. The decarburization shall be examined at $\times 100$ magnification on a test specimen suitable etched and cut from a full cross-section of the test bar showing at least 25 mm of the original perimeter, as per IS 6396 : 1983.

NOTE — Points of extreme depth of decarburization shall not be excluded.

9 INCLUSION RATING

9.1 The inclusion rating when determined as per IS 4163 : 1982 shall not be worse than 2.5 A, B, C, D both for thick and thin series given in Fig. 2 of IS 4163 : 1982.

10 FREEDOM FROM DEFECTS

10.1 The hot-rolled material shall be free from harmful defects, namely, seams, folds, laps, cracks, deep pits, grooves, excessive scaling, etc, which may lead to cracking during hardening or impair serviceability. The surface shall be reasonably smooth and free from distortion, twists and kinks. Unless otherwise agreed to between the purchaser and the manufacturer, out of straightness to the extent of 7 mm per 2 m length shall be accepted.

10.2 The depth of the seams and laps in the longitudinal direction shall be 2 percent *Max* of the section thickness. There should be no defect in transverse direction.

11 DIMENSIONS AND ROLLING TOLERANCES

11.1 The dimension of rib and groove sections shall be as shown in Fig. 1. The rolling tolerances on width and thickness shall be as specified in Table 3.

11.2 The total reduction in thickness between the outer edges and the middle of the flat, due to concavity of either or both the broad faces shall be as follows:

Width of Flat		Maximum Permissible
Over	Up to and Including	Total Reduction in Thickness due to Concavity
	mm	mm
—	75	0.36
75	100	0.46
100	125	0.56
125	150	0.66

11.3 Unless otherwise agreed to between the purchaser and the manufacturer out-of-straightness to the extent of 7 mm per 2 m shall be acceptable.

12 CAMBERING TEST

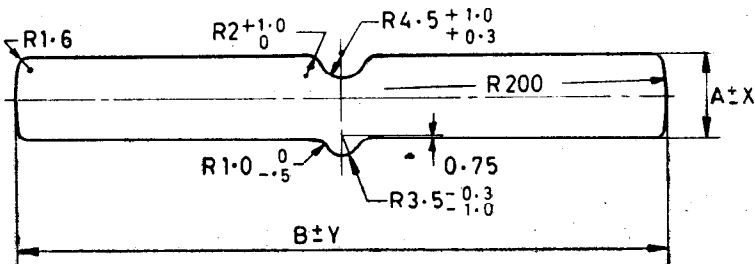
12.1 One test specimen from each cast or from each delivery of less than one cast shall be selected and tested in the presence of the purchaser or his representatives.

Table 3 Rolling Tolerances on Rib and Groove Sections
(Clause 11.1)

Thickness	Tolerance (X)		Width	Tolerance (Y)	
	Plus	Minus		Plus	Minus
(1)	(2)	(3)	(4)	(5)	(6)
mm	mm	mm	mm	mm	mm
10	0.20	0.15	50 63	0.30 0.38	0.30 0.38
11	0.22	0.15	75 90	0.45 0.54	0.45 0.54
13	0.26	0.20	100 115	0.60 0.60	0.60 0.60
16	0.32	0.24	120 125	0.60 0.62	0.60 0.62
19	0.38	0.28	140 150	0.70 0.75	0.70 0.75

NOTE — The edges radius shall be 200 mm.

12.2 Each test specimen shall have a length of 60 a, where a is the thickness of the test piece. It shall be cambered to a radius of 80 a and then suitably hardened and tempered so as to obtain hardness value in the range of 380 to 420 Brinell hardness number. The required camber shall be 5.5 a and any adjustment of the camber which may be necessary, shall be made at the tempering temperature. The cambered test piece shall be pressed straight once between two straight parallel surface and the camber after release of the load, shall be not less than 5 a. The test piece shall then be pressed straight six times in



NOTES

- 1 For permissible concavity of faces, see Note in Table 3.
- 2 The axes of the rib and groove shall not vary from the centre of flat by more than 1.50 mm and shall be coincident.
- 3 For dimensions A, B and tolerances X, Y see Table 3.
- 4 The dimensions marked as 1.6R, 200R and 0.75R are for information only and these are nominal values.

FIG. 1 RIB AND GROOVE SECTIONS

quick succession and shall then show no further permanent set. The calculated values for the dimension specified are given in Table 4.

Table 4 Calculated Values of Dimensions
(Clause 12.2)

All dimensions in millimetres.										
Thickness of flat, a	6	8	10	11	13	14	16	19		
Length of test piece 60 a	360	480	600	660	780	840	960	1 140		
Initial camber, 5.5 a	33	33	55	60.5	71.5	77	88	104.5		
Minimum camber after first blow and next five consecutive blows, 5 a	30	40	50	55	65	70	80	95		

12.3 Should a test piece first selected by the purchaser or his representative not fulfil the test requirements specified in 11.2, two further test pieces shall be taken, one of which shall be from the original flat unless this has been withdrawn by the manufacturer. Should either of these further test pieces fail, the material, represented by the test pieces, shall be deemed not to comply with this standard.

13 CALCULATION OF MASS

The mass of the material shall be calculated on the basis that the steel weight 7.85 g/cm³.

14 SAMPLING

14.1 Chemical Analysis

One flat for every 20 tonnes or part thereof the material from the same cast shall be analysed as per requirements given in 6. The analysis results obtained shall meet requirements of product analysis as stipulated in Table 1.

14.2 Hardness Test

Two percent of the flats of the same section and cast shall be tested for hardness in accordance with IS 1500 : 1983. The average of three readings for hardness shall comply with requirements given in Table 2.

14.3 Dimensional Check

Three percent of flats selected at random shall be checked for conformity with the requirement of dimensions and tolerances as specified in 11.

14.4 Decarburization

Two percent of a flats (by number) of the same section and if annealed two percent from each annealed batch (by number) selected at random, shall be tested for decarburization.

14.5 Inclusion Rating

Two samples of the flats of the same section and cast selected at random, shall be tested for inclusion rating.

15 DELIVERY

15.1 The material shall be supplied in any one of the following conditions, subject to mutual agreement between the purchaser and the manufacturer:

- As rolled, or
- As rolled and annealed.

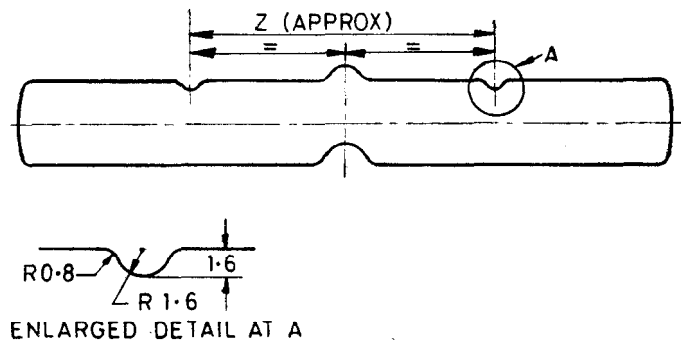
15.2 The material may also be supplied in shot or sand blasted condition if agreed to between the purchaser and the manufacturer.

15.3 The surface of the material may be coated with a thin layer of anti-rust oil, or anti-rust compound when agreed to between the purchaser and the manufacturer.

16 MARKING

16.1 Each flat shall be stamped with the name or trade-mark of the manufacturer, grade and cast number or any such identification marks by which the steel may be traced to the cast from which it has been made. Such marking shall be made at the extreme end of each flat. Steel designation shall also be marked.

16.1.1 The material shall bear identification grooves as shown in Fig. 2.



Steel Grade	Z in mm (Approx)	Remarks
Grade 1	—	Plain without grooves
Grade 2	25	Two grooves 25 mm apart
Grade 3	35	Two grooves 35 mm apart
Grade 4	45	Two grooves 45 mm apart
Grade 5	30	Two grooves 30 mm apart
Grade 6	40	Two grooves 40 mm apart

NOTES

- 1 In rib and groove sections the identification grooves shall be in the rib side.
- 2 For dimensions of the rib and groove, see Fig. 1.

FIG. 2 IDENTIFICATION GROOVES FOR DIFFERENT GRADES OF SPRING FLATS

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Doc : No MTD 4 (3464)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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AMENDMENT NO. 1 APRIL 1995

TO

IS 3885 (Part 2) : 1992 STEEL FOR THE MANUFACTURE OF LAMINATED SPRINGS (RAILWAY ROLLING STOCK)

PART 2 RIB AND GROOVE SECTIONS

(*Second Revision*)

(Page 2, Table 1) – Substitute the following for the existing table:

Table 1 Chemical Composition
(*Clauses 3.1 and 6.1*)

Grade	Designation [see IS 1762 (Part 1) : 1974*]	Type	Constituent, Percent							
			Carbon	Silicon	Manganese	Sulphur Max	Phosphorus Max	Chromium	Vanadium	Molybde- num
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	55C6	Water-hardening	0.50 to 0.60	0.15 to 0.30	0.50 to 0.60	0.050	0.050	—	—	—
2	75C6	Oil-hardening	0.70 to 0.80	0.15 to 0.35	0.50 to 0.80	0.050	0.050	—	—	—
3	40Si7	Water-hardening	0.35 to 0.45	1.50 to 2.00	0.80 to 1.00	0.030	0.030	—	—	—
4	55Si7	Oil-hardening	0.50 to 0.60	1.50 to 2.00	0.80 to 1.00	0.030	0.030	—	—	—
5	50Cr4V2	Oil-hardening	0.45 to 0.55	0.15 to 0.35	0.50 to 0.80	0.030	0.030	0.90 to 1.20	0.15 to 0.30	—
6	60Cr4V2	Oil-hardening	0.55 to 0.65	0.15 to 0.35	0.80 to 1.00	0.030	0.030	0.90 to 1.20	0.15 to 0.30	—
7	51CrMoV	Oil-hardening	0.48 to 0.56	0.15 to 0.40	0.70 to 1.10	0.030	0.030	0.90 to 1.20	0.07 to 0.12	0.15 to 0.25

* Code for designation of steel : Part 1 Based on letter symbols (*first revision*).

(Page 2, clause 9.1, line 2) – Substitute '2.0' for '2.5'.

(Page 2, Table 2, headed under Grade) – Substitute '51CrMoV' for '51CrMoV4'.

(Page 4, clause 15.1) – Substitute the following for the existing clause:

"15.1 The material shall be supplied in 'as rolled' condition."